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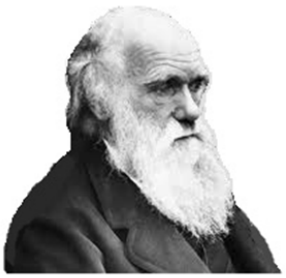

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Bacteriological Quality Assessment of Shallow Wells in Sabion Gari settlement of Girei Local Government Area of Adamawa State

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ABSTRACT

Shallow well water is one of the major source of drinking water in Girei Local Government. In the Present study, the bacteriological quality and physico-chemical properties (pH and temperature) of water samples collected from selected shallow wells in the study area were assessed. Therein, the organisms isolated from the well water are *Escherichia* and *Klebsiella*spp. The coliform count of the water sample collected from the wells as determined by most probable number method falls between 350-1800+ coliforms / 100m1, while the heterotropic bacteria from the sample were in the range of 7.2×10^3 - 2.88×10^4 cfu/ml. Moreover, the pH and temperature of the water falls around 5.5-7.1 and 15-21 °C, respectively. This study showed that the water samples obtained from wells in Sabon Gari are heavily contaminated with coliforms. This is of serious concern because of the association of the coliforms with pathogenic *enterobacteriaceae*.

***Keywords*:** Water, Sabon Gari, Escherichia, Klebsiella, Coliform

1. INTRODUCTION

The lack of safe drinking water in most rural communities has suddenly become a major public health problem. Every year millions of lives are claimed in developing countries,

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where scarcity of piped water has made communities to find alternative sources of water, resorting to ground water sources as cheap alternatives to clean, and healthy water. The lack of safe drinking water and adequate sanitation measures leads to a number of diseases such as cholera, dysentery, salmonellosis and typhoid. Water is the essence of life and safe drinking water is a basic human right essential to all [1]. It is also essential for the wellbeing of mankind and for sustainable development. Though necessary for human survival, many are denied access to sufficient potable drinking water supply and sufficient water to maintain basic hygiene. The effect of drinking contaminated water results in thousands of deaths every day, mostly in children under five years in developing countries [2]. Thus, access to safe clean water and adequate sanitation is a fundamental right and a condition for basic health [3].

The use of shallow ground water sources for drinking and other domestic purposes is a common feature for many rural communities in developing countries. The quality and purity of shallow wells have direct effect on human health. The problem of shallow well quality is more acute in areas that are densely populated [4-6], which may result in contamination of shallow wells supplies with different bacteria including pathogens. There is a common misconception among people that groundwater is generally safe for human consumption. However, it is not proper to presume that ground water is generally safe owing to qualitative changes in groundwater, especially in the high-density residential areas where sewage disposal practices are not properly done [7,8].

Bacteriological examination of water samples is usually undertaken to ensure that the water is safe to drink or bathe in. Many potential pathogens could be associated with water; it is thus impractical to screen samples for all possible pathogens. Instead, various indicator organisms have been used as surrogate markers of risk. Most waterborne diseases are related to faecal pollution of water sources, therefore water bacteriology is largely based on the need to identify indicators of faecal pollution such as coliforms and Escherichia coli, but the use of enterococci and Clostridium perfringens is increasing. From the foregoing, it is pertinent that there is need to clarify the concern; the safety and quality of water used for drinking within most of these communities.

Therefore, this study is designed to determine the bacteriological quality of water collected from shallow wells located in Sabongari settlement, Girei Local Government Area of Adamawa State.

2. MATERIALS AND METHOD

2. 1. Study area

The study area is a small settlement in Girei Local Government Area of Adamawa State, Nigeria. The area is dominated by strangers consisting of students, artisans, traders and a few Civil servants.

2. 2. Sample collection

Samples were collected in sterile 1.5 liter containers and labeled with appropriate codes, using the first letter of the name of the area and then a number ranging between 1and 4 depending on the total number of samples collected from the location. The samples were immediately transported to the laboratory of the Department of Microbiology, Modibbo Adama University of Technology, Yola for immediate analysis.

2. 3. Physiochemical analysis

The pH readings of the water samples were taken using a pH meter according to the method described by [9]. A simple thermometer was used to measure the temperature of each water sample.

2. 4. Bacteriological analysis

Total heterotrophic bacteria in the water samples were obtained using pour plate method. Stock cultures of the isolates with different cultural characteristics were made on nutrient agar. Gram staining was used to identify bacteria based on morphological characteristics. Indole, methyl red, citrate [10] and Voges-proskaeur utilization tests were performed to confirm presence of bacteria based on chemical reactions [10].

3. RESULTS

The pH and temperature of the water samples ranged between 6.6-7.1 and 10-21 °C respectively (Table 1). The total heterotrophic count (THC) of the well water ranged between 2.85×10^4 - 7.2×10^3 cfu/ml (Table 2). The result of the MPN test of the well water sample is giving in Table 3. The water sample were heavily contaminated with coliforms. Only samples from one sample sites had an MPN of coliforms of 350. The other samples had higher values of 1600+ coliforms. Result of the biochemical tests carried out on the isolates on MacConkey agar in the completed test showed that the isolates were *Escherichia coli* and *Klebsiella spp.* (Table 4).

Table 1. pH and Temperature of water samples from Sabon Gari Settlement

Location	Sample	pH	Temperature (°C)
Zuma	A_1	6.9	15
	A_2	6.7	20
	A_3	6.9	21
	A_4	6.9	20
Dogo	B_1	6.6	10
	B_2	5.6	17
	B_3	5.5	18
	B_4	5.5	18
Peace	C_1	7.0	21
	C_2	7.1	21

	C_3	6.9	20
	C_4	6.9	21
Alaska	D_1	6.6	10
	D_2	6.6	12
	D_3	6.2	15
	D_4	6.6	12

Table 2. Total Heterotrophic Count of Water Samples from Sabon Gari Settlement.

Location	Sample	Colonies	Cfu/ml
Zuma	A_1	203	2.03×10^4
	A_2	101	1.01×10^4
	A_3	76	7.60×10^3
	A_4	96	9.60×10^3
Dogo	B_1	85	8.53×10^3
	B_2	72	7.20×10^3
	B_3	76	7.61×10^3
	B_4	76	7.61×10^3
Peace	C_1	169	1.69×10^4
	C_2	122	1.22×10^4
	C_3	111	1.11×10^4
	C_4	167	1.67×10^4
Alaska	D_1	284	2.84×10^4
	D_2	252	2.52×10^4
	D_3	288	2.88×10^4
	D_4	203	2.03×10^4

Cfu/ml: Coliform Forming Unit Per ml

Table 3. Most Probable Number of Coliforms in Well from Sabon Gari Settlement.

Water Sample	NTBLB (10 ml) Showing Gas Production	NTSTLB (1 ml) Showing Gas Production	NTSTLB (0.1 ml) Showing Gas Production	MPN
A	5	5	4	1600
B	5	5	5	1800+
C	5	4	4	350
D	5	5	5	1800+

Key: **NTBLB**: Number of Tubes of Double Strength Lactose Broth
NTSTLB: Number of Tubes of Single Strength Lactose Broth

Table 4. Identification of Bacteria Isolated From Water Samples from Wells in Sabon Gari Settlement

CAM	CS	CT	IND	MR	VP	SF	GRS	BI
Small Smooth Pink Colonies on MacConkey Agar	Rod	-	+	+	-	-	-	*Escherichia coli*
Mucoid Pink Colonies on Mac-Conkey Agar	Rod	+	-	-	+	-	-	*Klebsiella*

Key: **CAM**: Colony Appearance on MacConkey Agar, **CS**: Cell Shape, **CT**: Citrate, **IND**: Indole, **MR**: Methyl red, **VP**: Vogesproskaur, **SF**: Spore Forming, **GRS**: Gram Stain, BI: Bacteria Identified

4. DISCUSSION

The pH of the water samples has the lowest value to be 6.6 and the highest value to be 7.1. The pH range is close to neutrality and would allow the growth of most bacterial species. Palamuleni [3], obtained similar pH ranges of 6.54-7.80 and 6.54 to 7.90 for well water. Most of the pH values obtained is within the W.H.O standards according to W.H.O 2000 [11]. The pH in high class water should be in the range of 7.0-8.0 and the lowest pH is 6.6 while the higher is 7.1. The most probable number falls between 350-1800+/100m1 of water which indicates that the source of water is not fit for consumption because they do not fit the official standard of coliforms organism in water guidelines for drinking water quality, which allows 10 coliforms per 100 ml of drinking water [2].

The presence of significant levels of coliform bacteria in the water samples may be attributable to the shallowness of the wells, in combination with a compromise of the sanitary

integrity of the well [5]. In addition, indiscriminate open defecation by humans is common practice in these areas and this could be a source of faecal coli form contamination of the wells from surface run offs. The bacteria isolated from the water sample include *Esherichia* coli and *Klebsiella* spp. These pathogens can enter water from inadequately treated sewage discharges and animal feed. The isolate of *E.co1i* and *Klebsiella* spp is a strong indication that the water samples contains pathogenic organisms and are not potable for drinking and if ingested, may cause human illness ranging from life threatening; diseases such as diarrhea and dysentery to minor intestinal, respiratory and skin diseases. This is in line with the report of other authors elsewhere in Nigeria. High level of faecal bacteria in warts smock indicate the possible presence of pathogenic (disease causing) organisms. From the result of the bacteria identification carried out, it is evident that diseases such as cholera, typhoid fever, bacteria dysentery, infectious hepatitis and food poisoning can possibly result from the consumption of the water. Eye, ear, nose and throat infections can also spread from contact with the water. The presence of these bacteria indicates that the sanitary conditions of shallow wells are very poor. Heterotrophic bacteria from all the samples were in the range of $7.2x10^3$-$2.88x10^4$cfu/ml. This may be as a result of human activities around this wells, all the samples analyzed showed the presence coliforms and heterotrophic bacteria.

5. CONCLUSION

This study shows that the water samples obtained from wells in Sabon Gari are heavily contaminated with coliforms. The contamination of the water is of serious concern because of the association of the coliforms with pathogenic enterobacteriaceae. This can lead to infections such as typhoid, fever and dysentery etc. The well water should be purified in order to make it safe for drinking and other purposes. The well should be well covered to prevent contamination and the wells should be disinfected adequately.

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